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#### ABSTRACT -- KEY POINTS

Version 2 coding continued to be a major thrust of our work during this period. In BRDF/Albedo, processing of AVHRR data of the Southern Amazon was completed. The BRDF database prototype was completed. Processing of Jornada field albedometer data continued, with some difficulties. In Land Cover/Land-Cover Change, the Central America prototype map and database was completed. Work with AT classifiers continued. We prepared to move to development of the North America training data base in collaboration with the EDC DAAC.

#### TASK PROGRESS

##### BRDF/Albedo Product

##### Algorithm development

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\* The MOD43 version 2 code was in its core written in the fall of this period and finished towards the end of the year. It is a complete reworking of the version 1 code, transforming it into an operational algorithm that will run much faster (ca. 100 MFlops/16 days). In July the BRDF model handling was installed, in August the i/o sections. In October quality control was added and writing of SDS attributes, in November metadata was completed and testing begun.

\* The completed MOD43B BRDF/albedo version 2 code was delivered to SDST on December 12. The deadline had been December 15. The code was accepted into CM a few days later. It was subsequently successfully tested with the quarter-tile output generated by MOD\_PRAGG.

\* Parallel to the coding of the main algorithm there was nontrivial coding of an input data simulator (required since the upstream algorithms required for testing are not operational yet) and of tools for dumping HDF file contents in product-specific ways. These were essential in off-line testing of the algorithm, which was conducted in November and early December.

\* The code building the multiangular input database is now no longer called MOD43A but has received the MODLAND designation MOD\_PRAGG. It was coded by Sadashiva Devadiga.

\* At a MODLAND-SDST meeting in July the version 2 deliveries were coordinated and the metadata requirements were updated.

\* Version 1 PGEs 22 and 23 were integrated into the DAAC.

\* A. Strahler led negotiations on networking links between BU and GSFC and EDC.

## Scientific advances

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\* Completed: The processing of 2 months of 4km AVHRR data over South America (1987, 1988) begun in the previous period progressed to the stages of cloud clearing and bulk atmospheric correction in the fall. Finally, the MODIS BRDF/albedo algorithm was applied to the multiangular data set obtained to derive per-pixel BRDFs. Results obtained from this algorithm prototyping activity were: BRDF-corrected NDVI shows better correlation with surface types in the LBA experimental area than traditional maximum-value NDVIs, BRDF-derived albedos are spatially consistent and show seasonal variation.

\* Ms. Baoxin Hu obtained her PhD from BU for her work on the MODIS BRDF/albedo problem, which consisted of model validation, sensitivity studies and the South America prototyping study.

\* The BRDF at-launch database project advanced to a point where land cover data in the Goode's projection can be remapped to the MODLAND grid and transformed via landcover type-specific BRDF parameters to albedo. The field-measured BRDF datasets used for this purpose have been rectified and processed to create standard BRDF shapes following a newly-defined 36/24/12-classes hierarchical BRDF type classification scheme.

\* W. Lucht met with Australian scientists in Melbourne and at CSIRO/COSSA in Canberra to discuss BRDF model testing and validation as there is a very good level of BRDF work going on in Australia; several Australian investigators are using the MODIS BRDF/albedo model.

\* A. Lyapustin of GSFC visited for discussions of BRDF issues and gave a talk.

\* Marc Leroy (France), leading scientist in the POLDER instrument team for atmospheric and land surface processing, visited BU to discuss BRDF issues and present first results from POLDER multiangular inversions.

\* A visiting scientist, Gerhard Meister (Germany) worked for two months on the BRDF modeling of man-made surfaces as occur in urban scenes.

## Validation activities

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\* Evaluation of the albedometer data and hemispherical photography taken in the previous period during the PROVE field campaign at Jornada has progressed. The hemispherical photos were digitized and a classification by cover component type undertaken. Field notes were transferred to electronic formats. The albedometer data were corrected for various effects and early tests of a mixture model conducted. Numerous difficulties in calibrating the hemispherical photography were encountered that held up work considerably.

\* There was a meeting with Jan-Peter Muller and Marc Leroy in October to discuss use of the Jornada albedometer data acquired in May for POLDER validation and spatial scaling studies in general. As a result, POLDER multiangular data were inverted with the MODIS BRDF model, atmospherically corrected and converted to broadband

parameters. These were then compared to the local field measurements. There was a moderate discrepancy, but the uncertainties involved are rather large and the spatial scales are very different.

- \* The existing surface radiation networks BSRN and SurfRad were investigated for the potential role in MODIS albedo validation.

- \* A. Hyman attended the PROVE validation campaign workshop in Denver to coordinate data evaluation.

- \* A. Strahler attended the validation workshop in December to coordinate with the newly selected EOS validation investigators. He will draft a requirements document for radiometric validation to guide the new investigators with respect to MODIS and MISR data products.

- \* MODLAND validation strategy for the first year were developed, focusing on rapid light aircraft campaigns for radiometric characterization.

#### Publication/talks activity

- \* A major paper describing the MODIS BRDF/albedo algorithm was published in the Journal of Geophysical research: (Wanner et al., JGR 102, 17143-17162, 1997).

- \* A paper validating the MODIS BRDF model was published in Remote Sensing of the Environment in November: (Hu et al., RSE 62, 201-214, 1997).

- \* A paper on expected retrieval accuracies from the MODIS BRDF/albedo algorithm received reviewer's comments and was resubmitted.

- \* A paper describing the 1km AVHRR-GOES8 prototyping of the MODIS BRDF/albedo algorithm over New England was submitted to the Journal of Geophysical Research in December.

- \* A paper describing correlations between BRDF parameters and biophysical surface parameters was submitted for an ENAMORS publication.

- \* A paper describing the 1km AVHRR-GOES8 prototyping of the MODIS BRDF/albedo algorithm over New England was printed in the IGARSS'97 conference proceedings

- \* A contribution was submitted for a joint paper by MODLAND for IEEE TGARS describing the BRDF/albedo algorithm and prototyping results

- \* W. Lucht (formerly Wanner) was made an Associate Team Member, replacing Curtis Woodcock

- \* W. Lucht attended the IAMAS/IAPSO conference in Melbourne in July to deliver to a community of numerical weather and climate modelers a talk on the 1-km albedo product from MODIS.

- \* W. Lucht attended the ENAMORS workshop in Finland in September, which

was designed to plot science strategy for the European Union and EOS-EU contacts, and gave a talk on the MODIS BRDF/albedo product.

\* Several BU team members attended the MODIS Science Team Meeting in October.

#### Land Cover/Land-Cover Change

\* Coding: Efforts throughout the 3rd and 4th quarters were focused on delivery of the at-launch V2 code for monthly aggregation of landcover input data. Code was delivered on 23 December 1997 in time for testing and integration before launch. The code was tested in-house by using actual output from the daily aggregation code (MODAGG), the BRDF/Albedo code (MOD43), and the surface temperature code (MOD11), thus verifying completion of this level-3 stream of data.

\* Central America Prototype: We completed test site development and testing in Central America, and began algorithm testing using our advanced technology (AT) classifiers, especially the neural net and decision tree classifiers. We generated a detailed regional map of Central America based on supervised classification.

\* AT Classifiers: We continued research on neural net classifiers, especially processing issues. We expanded algorithm testing to the Central America test site database and developed the first regional land cover products based on supervised classification using neural network and decision tree classifiers.

\* Land Surface Parameter Database: We continued the development and testing of a land surface parameter database derived from Landsat TM and ancillary sources, especially for two of our regional test sites, Central America and the Southwest US (including Jornada and Walnut Gulch). We conducted field work at the Harvard Forest LTER tower site and continued analysis of the Central America and Southwest US test site (Jornada and Sevilleta LTERs) data. We began planning for development of training, testing and validation sites for North America.

\* DAAC Interaction: We continued work to fully establish a functional link with the EDC-DAAC for the subsetting and processing of Landcover/Land-Cover Change data at Sioux Falls.

\* Other Interaction: We also continued meetings with other groups active in land cover characterization including the University of Montana, University of Maryland and the Land Cover Group at EDC.

\* Visitors: Bob Murphy visited Boston University on 21 November to discuss Land Cover and BRDF issues. Dr. Laurence Hubert-Moy of the Universite de Rennes worked at BU during this period as a visiting researcher primarily investigating data transformations for mapping wetlands and scaling issues using our Central America dataset. Aaron Moody visited Boston University partly to discuss test site data sharing.

#### ANTICIPATED ACTIVITIES DURING THE NEXT QUARTER

\* Iteration of the version 2 codes with SDST until baselining

\* Submission of a paper on the South America AVHRR inversion results

\* Completion of the evaluation of the Jornada albedometer field data

\* Start North America database acquisition for land cover.

\* Begin DAAC interaction prototyping with EDC.

#### PROBLEMS/CORRECTIVE ACTIONS

\* None